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PICTURE TECHNIQUE

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and

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CONTROLLED READING BY MEANS OF A MOTION PICTURE TECHNIQUE*

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I

In an earlier number of this Journal, we described in detail a new motion picture technique for improving reading by controlling the saccadic eye-movements.¹ Since then, we have uncovered certain improvements, especially as regards methods of projecting the film, which should be made available to those who are thinking of using the technique in their work. Before proceeding to these matters, however, it will be well to review the essential features of the technique as already announced.

Briefly, the technique consists of photographing reading material on motion picture film in such a way that when the film is projected, successive units of the separate lines are seen exposed tachistoscopically across the screen. Two forms of presentation are used: In the first, the successive units are exposed discretely; in the second, they are added in the form of increments to the material already exposed. The reader's task, in either case, is to keep pace with the rate at which he is being directed through the material. Theoretically, he should encounter no difficulty. For one thing, the abruptness with which the units appear, especially in the first type of presentation, is so attention-compelling that the reader more or less involuntarily moves his eyes along in time with the periodicity of the exposures. He may have some tendency to fall behind while reading exercises of the second type. Since in this type of exercise each unit is permitted to remain on the screen after it is exposed, there is nothing actually to prevent him from lingering on any individual unit or from regressing to material previously exposed.² On the whole, however, the persons to whom the

* Recommended for publication by Dr. J. R. Kantor, April 6, 1933.

¹ Dearborn, Walter F., and Anderson, Irving H., assisted by Brewster, James R. A new method for teaching phrasing and for increasing the size of reading fixations, *Psychol. Rec.*, 1937, 1, No. 28, 459-475.

² It may not be particularly damaging to permit regressions to occur, if the reader is able to recover the ground which he loses in the meantime. Regressions normally occur even in superior reading.

films have been shown have not complained of any difficulty in following the sequence of exposures, even while reading the second type of exercise. Most of them seem to learn quite as readily in this method as in the other to anticipate the appearance of the next unit and to move their eyes to it as soon as it appears.³ Whatever tendency certain individual cases may have to fall behind may, we believe, be largely overcome by first giving them practice in reading the material in which the units are exposed discretely. It may be of interest to remark in passing that most persons are rather inclined to believe that the second type of exercise is somewhat easier to read than the first, probably because the former reproduces the processes of normal reading more closely than the latter. In the second type of presentation the reader may profit, as he does in normal reading, by marginal impressions of the material already read.

As was indicated in the earlier report, the principal advantage of controlling the saccadic eye-movements by a photographic technique rather than by a mechanical one lies in the fact that the former permits the material to be presented more nearly in the way in which it is ordinarily read. For example, the number of units exposed per line and the exposure time per unit may vary according to the way in which the number and duration of the reading pauses vary. This is in contrast with even such an elaborate instrument as the Metron-O-Scope⁴ which permits only a fixed number of exposures per line and which does not allow for a difference in the exposure time of the individual units. To present the material so mechanically creates, of course, a very artificial reading situation. The number of fixations per line and the exposure time per fixation varies significantly in ordinary reading, as an eye-movement record of even a superior reader will show. The failure of eye-movements to show the constancy which the Metron-O-Scope

³In both cases, of course, it will be necessary to establish experimentally whether or not the reader follows the sequence of exposures as intended. This, we shall do by photographing the eye-movements of a group of subjects while they read the film material before an eye-movement camera. In the same experiment, we intend to determine the exposure times which will confine readers at different levels to a single fixation of the exposure units. An investigation of the latter problem is particularly important because the value of the technique as a means of increasing the span of recognition is almost wholly dependent on whether or not an exposure time is used which limits the reader to a single glance of the units shown. A report of the results of this experiment will appear in a forthcoming number of this Journal.

⁴A triple-shutter tachistoscope distributed commercially by the American Optical Company, Southbridge, Massachusetts.

presupposes has been shown by numerous investigators, most recently by Sisson.⁵

One may, if he wishes to be meticulous, reproduce normal reading quite faithfully with respect to the number of units exposed per line and the exposure time per unit. What needs to be done, of course, is first to photograph the eye-movements of a superior reader of the level for which a film is being prepared while he reads the material which is to be photographed in the form of the above exercises. The points of fixation along the separate lines are located by means of the well-known technique of projecting the eye-movement record upon a duplicate of the material read before the camera. The time of the individual fixations may be determined in the same operation. Thus, one is enabled to determine not only the number of fixations per line and their duration, but also the approximate units in which the material was read. Once the phrasing and the fixation time have been established, it is a simple matter, as we have already explained,⁶ to photograph the material so that it will be presented in approximately the same units and time in which it was read by one superior reader at least. That another good reader of the same grade level would read the material differently is, of course, granted. This is a limitation which can, however, be partially overcome by basing the phrasing and the exposure time on the average performance of several good readers rather than on that of one alone.

Another method for determining these matters is as follows: We first select materials for reading which are well standardized as to vocabulary load, intellectual level, and maturity of interest and appeal to the particular grade for which the record is being prepared. Most of the words and phrases may be divided into "natural" units which are almost obvious and on which experienced teachers would agree. Occasionally, divisions of word and phrase are made about which there may well be difference of opinion. We have simply used the phrasing which to us seemed to be the most meaningful. Wherever possible, we have tried to maintain intact such logical groupings as prepositional phrases, short clauses, familiar idioms, and so forth. Wherever a variation in context occurred, which was known to influence the number and duration of the reading pauses in a specific way, we have attempted to vary the form of presentation accordingly. In our films, for example, unusual

⁵ Sisson, E. D. Habits of eye-movement in reading, *J. Educ. Psychol.*, 1937, 28, No. 6, 437-450.

⁶ Dearborn, Walter F., and Anderson, Irving H., *op. cit.*

expressions, difficult words, unfamiliar names and places, and unusually long phrases are exposed for a slightly longer period than the average, whereas familiar expressions, common words, and short phrases are shown for a somewhat shorter time than the average. Account has been taken of numerous other objective factors which have been shown to affect the number and duration of the reading pauses.

The films thus prepared will then be tried out experimentally by photographing the eye-movements of some of the better readers as they read them. The films will then be reedited in the light of these findings. We are now proceeding with this experimental check of the materials thus far prepared.

A photographic technique permits another refinement of which brief note should be made. By means of either a multiple-exposure or a multiple-printing technique, it is possible to produce a type of film which when projected onto the screen shows the successive phrases appearing in the context of an obscure image of the section of material being presented. Either of the two methods of exposing the units may be used. These films, while still retaining the tachistoscopic feature, are calculated to reconstruct the processes of normal reading even more closely than the others do. By providing the background of text, we permit the reader now to profit by marginal impressions from all directions. The phrases are literally exposed in context.

II

Despite the fact that our technique has been refined as above described, it still falls considerably short of providing a normal reading situation. To require a person to read under the usual conditions of motion picture projection is, in itself, atypical. For one thing, a person ordinarily reads from a page which is much smaller in size than the screen area used in projecting motion picture films. Moreover, standard reading material is printed black on white, whereas motion picture titles appear white on black or gray. Finally, ordinary reading is done in daylight or under artificial light, not in a room which has been semi-darkened. Not only are there these differences in physical conditions, but the posture which a person assumes while reading from a page is different from that which he adopts while viewing a motion picture screen. Even though these differences between the two situations may appear to be negligible, we feel that it would be desirable to erase them

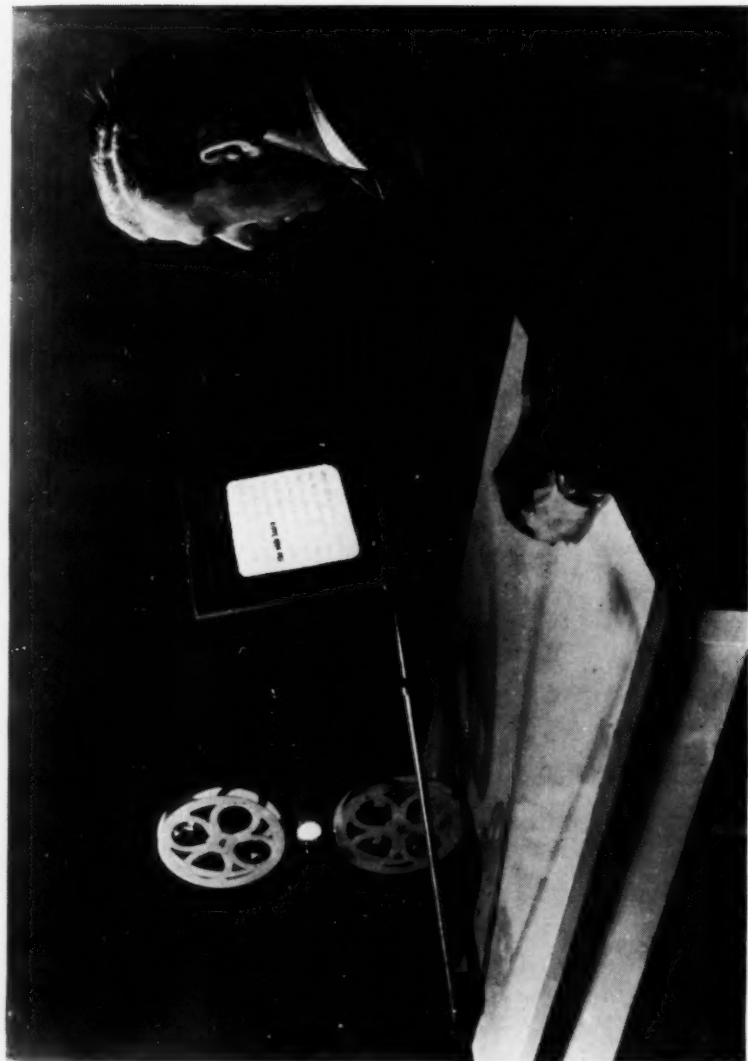


Figure 1. Arrangement for projecting reading material in miniature.

insofar as possible. Otherwise, a person may not be able to approach the task of reading our film material with quite the same attitude which he adopts in his normal, everyday reading of books, magazines, and so forth. The transfer value of the films would thereby be reduced.

Fortunately, a photographic technique may be modified so that it will not present these limiting conditions. The first of these limitations, namely, that the screen area ordinarily used in motion picture projection is atypically large, may be overcome simply by decreasing the projection distance. All standard models of 16 mm. projectors focus within a range of distance which enables one to secure as small an image as he desires. A useful arrangement for projecting the material in miniature is shown on Fig. 1. A small translucent screen is placed directly in front of, and parallel to, the projector lens. Any translucent material which gives a high degree of diffusion and reduces glare may be used for the screen. Of the materials with which we have experimented, plain white bond paper seems to serve the purpose as well as any other. The rod to which the screen is mounted slides back and forth within a tube to decrease and increase the size of the image, respectively.⁷ It is of course understood that the image must be refocused each time the position of the screen is changed.

By projecting the material in miniature, one automatically eliminates another one of the limitations usually associated with motion picture projection, namely, the need of having to darken the room. Since the total amount of light is concentrated on a much smaller area in close projection, the brightness of the screen will contrast sufficiently with the surrounding light to give good legibility to the titles, regardless of the prevailing conditions of illumination. The best effect is secured when the titles are shown in black type on a white or gray background. When it is shown white on black or gray, the words are so intense that they tend to over-stimulate the eyes. This difficulty is not encountered in connection with the background when the text is presented in black, for not only is the light more diffuse but the background on the film has been fogged in the photography. Whatever glare remains may be dampened by the use of proper screen material or by reflecting the material indirectly onto the screen by means of a mirror. Aside from these considerations, however, it would be desirable, as we have

⁷ The image shown on the screen of Fig. 1 is disproportionately large. The enlarged image has been cut from another picture and superimposed on this print for purposes of legibility.

indicated above, to present the text in black if only for the reason that ordinary reading material is printed that way. The material may still be photographed by the method previously described. All that need be done to present the material in black is to reprint a print of the original negative. If only one film is needed, the negative itself may be used. We have experimented with several methods of securing a negative, a print of which would give us the desired result, but none of these seem as time-saving nor as economical as the method already developed, even though it involves the additional step of reprinting. For once a print is secured, as many reprints as are needed may be made of it. In this respect, nothing more is involved here than in printing a negative.

Perhaps the most desirable feature of the projection method shown on Fig. 1 is that the screen may be placed at a height and tilted at an angle which permit the reader to adopt a posture more or less typical of normal reading. He looks down at the screen in somewhat the same manner in which he looks at the pages of a book being held in his hands. It should be remembered that when a screen is viewed from the front, the film must be inverted on the reel. The material otherwise will not read correctly from left to right. Ordinarily, the emulsion side is *out* when the film is projected by means of reflected light, and *in* when it is projected by means of transmitted light. These relations are reversed when a negative or a reprint is projected.

The effect of reading from a book can be made even more

The next morning the men set to work in real earnest, and the buildings rapidly neared completion. Every man helped, whether he was a carpenter or not. Doctors, aviators, radio men, scientists - all worked **shoulder to shoulder**. They thought only of the comfort and happiness of the little group to which they were so glad to belong and of their great opportunity.

One building after another was completed and Little America became a good-sized village. The main building housed the Commander's office, bunks for the men,

and a library, in which the Admiral had placed twelve hundred good books to help the men while away the winter hours. There was a radio department for sending and receiving messages. George ruled the mess hall, and three times a day the cheerful band gathered to eat his well-cooked food. Besides the main building, there were the gymnasium, the laboratory, the doctor's office, the storehouses for food, supplies, and medicine.

As winter settled down upon the camp, the snow buried the little village deeper and deeper, until not

Figure 2. Enlarged print of a frame of film showing how two pages of text may be projected onto the screen.

realistic by presenting the material as shown on Fig. 2. Here, the subdued images of two full-length pages of text are projected onto the screen at once. The successive phrases are exposed as before, except that now the reader is directed from the end of one page to the beginning of the next without pause. While he is engaged in following the sequence of exposures on the second page, the page which is to follow is unobtrusively substituted for that which occupied the position on the first half of the screen. Thus as each page is finished, it is replaced by a succeeding one so that the reader may read continuously from one page to the next without ever having to await the appearance of the new page. He is now permitted to read more or less in the way in which he is accustomed to peruse consecutive pages of a book. This is an improvement over the older method of presentation in which the reader was obliged to adopt the atypical procedure of returning to the same point on the screen each time that he moved his eyes to the beginning of a new section of material. There are other advantages to this newer method of presentation. By permitting the reader to move his eyes directly from the end of one page to the beginning of the next, which he knows is already in view, we have reduced whatever tendency he might have had in the older method to change his accommodation during the pause which intervened between successive sections of the material. The fact, too, that the text is no longer broken up into atypically small units is an advantage. The reader now really has the feeling that he is reading an intact page, whereas before he did not.

In order to prepare material for presentation in the above form, the method of photography need be modified but slightly. The first two cards of a selection are placed side by side directly beneath the camera lens in a specially constructed holder. Since the field now to be photographed is larger than before, the camera must be moved away or a lens with a shorter focal length used. The individual units on one card and then on the other are successively photographed by the method previously described, preferably in the form of the isolated phrases. The card not being photographed is, of course, completely masked. Note is made of the footage at the end of each card. This much done, the operator winds the film back to the beginning, being careful not to permit any light to enter the lens. A rubber cap may be placed over the lens during this operation. Having decreased the amount of lighting and closed down the

camera lens, he exposes the film again with all of the material on both cards unmasked. This gives the background of text on the film. After enough of the film has been double exposed to have reached a point somewhat beyond the footage noted above at the end of the first card, the switch is released to stop the camera and the next card is substituted for the first one.⁸ The switch is again closed and the camera allowed to run until the footage noted above at the end of the second card is reached. At this point full lighting is restored and the camera lens opened. With all of the material on both cards masked except the phrase being photographed, the successive units on the new card are photographed as before. When the end of this card is reached, the footage is again noted. The amount of film which was consumed in photographing the card is wound back to the beginning, and the film is double exposed to provide the background of text. The camera is momentarily stopped before the footage at the end of the card is reached to permit the substitution of a new card for the second one in the holder. The above routine is repeated with this card and with as many more as compose the selection.

⁸ Thus, when the film is projected, the obscure image of the next card to be read will appear on one side of the screen while the subject is engaged in reading the card on the other side. Instead of replacing the old card directly by the new one, one may effect this exchange by using a lap-dissolve, that is, the old card may be made to fade-out at the same time that the new card is being faded-in. We have also considered the possibility of using a brief fade-in and fade-out in exposing the successive units so that there would be a somewhat more gradual unfolding of the material. Some persons have objected to the films in their present form because the successive units appear with such abruptness that they tend to startle the eyes. This limitation could be overcome as above indicated, we think, without losing control of the reader's eye-movements.